

Maria Elena Innocenti, PhD

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Research interests

- Particle-In-Cell (PIC) methods and simulations:
 - semi-implicit, adaptive PIC methods and simulations;
 - PIC/ Monte Carlo methods and simulations;
- magnetic reconnection and kinetic instabilities in space plasmas;
- High Performance Computing;
- Data Assimilation for space weather forecasting models.

Education

IV 2009-V 2013	PhD in Applied Mathematics University of Leuven (KULeuven), Belgium Supervisor Prof. Giovanni Lapenta, University of Leuven Thesis Title “ <i>Simulating the heliosphere: from empirical models to a new numerical technique</i> ”
XI 2004-IV 2007	MSc in Physical Engineering Polytechnic University of Turin, Italy Grade 110/ 110 with honours Thesis Title “ <i>Onset and development of the Lower Hybrid Drift Instability in the terrestrial magnetosphere</i> ”
IX 2001-X 2004	BSc in Physical Engineering Polytechnic University of Turin, Italy Grade 110/ 110 with honours Thesis Title “ <i>Spectroscopic measurements of water and ammonia in the near infrared</i> ”

Professional experience

VI 2013- IV 2018	University of Leuven (KULeuven) Celestijnenlaan 200B bus 2400, 3001 Leuven, Belgium Postdoctoral researcher
VII 2007- IV 2009	Alenia Aeronautica 41, Corso Marche, 10146 Torino, Italy Software engineer / system integrator
VIII 2006-IV 2007	Los Alamos National Laboratory 87544 Los Alamos, New Mexico, US Trainee
XII 2005-III 2006	Fiat Research Center 50, Strada Torino, 10043 Orbassano, Italy Internship student
IV-VII 2004	Metrology Institute G. Colonnetti 73, Strada delle Cacce, 10100 Turin, Italy Internship student

Publications

Yang, S., Innocenti, M. E., Zhang, Y., Yi, L., and Jiang, W. (2017). Heating mechanisms of magnetized capacitively coupled argon plasmas excited by tailored voltage waveforms. *Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films*, 35(6):061311.

Zhang, Y., Peng, Y., Innocenti, M. E., Jiang, W., Wang, H.-y., and Lapenta, G. (2017). Electron kinetics in capacitively coupled plasmas modulated by electron injection. *Journal of Applied Physics*, 122(10):103301.

Innocenti, M. E., Cazzola, E., Mistry, R., Eastwood, J. P., Goldman, M. V., Newman, D. L., Markidis, S., and Lapenta, G. (2017a). Switch-off slow shock/rotational discontinuity structures in collisionless magnetic reconnection: What to look for in satellite observations. *Geophysical Research Letters*, 44(8):3447–3455. 2017GL073092.

Innocenti, M. E., Johnson, A., Markidis, S., Amaya, J., Deca, J., Olshevsky, V., and Lapenta, G. (2017b). Progress towards physics-based space weather forecasting with exascale computing. *Advances in Engineering Software*, 111:3 – 17. Advances in High Performance Computing: on the path to Exascale software.

Innocenti, M., Beck, A., Markidis, S., and Lapenta, G. (2016a). Momentum conservation in multi-level multi-domain (mlmd) simulations. *Journal of Computational Physics*, 312:14 – 18.

- Innocenti, M., Norgren, C., Newman, D. L., Goldman, M. V., Markidis, S., and Lapenta, G. (2016b). Study of electric and magnetic field fluctuations from lower hybrid drift instability waves in the terrestrial magnetotail with the fully kinetic, semi-implicit, adaptive multi level multi domain method. *Physics of Plasmas*, 23:052902.
- Innocenti, M. E., Tronci, C., Markidis, S., and Lapenta, G. (2016d). Grid coupling mechanism in the semi-implicit adaptive multi-level multi-domain method. *Journal of Physics: Conference Series*, 719(1):012019.
- Cazzola, E., Innocenti, M. E., Goldman, M. V., Newman, D. L., Markidis, S., and Lapenta, G. (2016). On the electron agyrotropy during rapid asymmetric magnetic island coalescence in presence of a guide field. *Geophysical Research Letters*, 43(15):7840–7849. 2016GL070195.
- Olshevsky, V., Deca, J., Divin, A., Peng, I. B., Markidis, S., Innocenti, M., Cazzola, E., and Lapenta, G. (2016). Magnetic null points in kinetic simulations of space plasmas. *The Astrophysical Journal*, 819(1):52.
- Innocenti, M., Beck, A., Ponweiser, T., Markidis, S., and Lapenta, G. (2015a). Introduction of temporal sub-stepping in the multi-level multi-domain semi-implicit particle-in-cell code parsek2d-mlmd. *Computer Physics Communications*, 189(0):47 – 59.
- Innocenti, M., Goldman, M., Newman, D., Markidis, S., and Lapenta, G. (2015b). Evidence of magnetic field switch-off in collisionless magnetic reconnection. *The Astrophysical Journal Letters*, 810(2):L19.
- Cazzola, E., Innocenti, M. E., Markidis, S., Goldman, M. V., Newman, D. L., and Lapenta, G. (2015). On the electron dynamics during island coalescence in asymmetric magnetic reconnection. *Physics of Plasmas*, 22(9).
- Beck, A., Innocenti, M., Lapenta, G., and Markidis, S. (2014). Multi-level multi-domain algorithm implementation for two-dimensional multiscale particle in cell simulations. *Journal of Computational Physics*, 271:430 – 443. Frontiers in Computational Physics—Modeling the Earth System.
- Ponweiser, T., Innocenti, M., Lapenta, G., Beck, A., and Markidis, S. (2014). Optimizing the Multi Level Multi Domain Particle In Cell code parsek2D-MLMD. In *Partnership for Advanced Computing in Europe (PRACE) project report*, <http://www.prace-ri.eu/IMG/pdf/wp118.pdf>.
- Skandrani, C., Innocenti, M., Bettarini, L., Crespon, F., Lamouroux, J., and Lapenta, G. (2014). FLIP-MHD-based model sensitivity analysis. *Nonlinear Processes in Geophysics*, 21(2):539–553.
- Innocenti, M., Lapenta, G., Markidis, S., Beck, A., and Vapirev, A. (2013). A Multi Level Multi Domain Method for Particle In Cell plasma simulations. *Journal of Computational Physics*, 238(0):115 – 140.

- Alvarez Mallon, D., Eicker, N., Innocenti, M., Lapenta, G., Lippert, T., and Suarez, E. (2012). On the scalability of the clusters-booster concept: a critical assessment of the DEEP architecture. In *Proceedings of the Future HPC Systems: the Challenges of Power-Constrained Performance*, FutureHPC '12, pages 3:1–3:10, New York, NY, USA. ACM.
- Innocenti, M., Lapenta, G., Vrsnak, B., Crespon, F., Skandrami, C., Temmer, M., Veronig, A., Bettarini, L., Markidis, S., and Skender, M. (2011a). Improved forecasts of solar wind parameters using the Kalman filter. *Space Weather*, 9(10).
- Innocenti, M., Lazar, M., Markidis, S., Lapenta, G., and Poedts, S. (2011b). Electron streams formation and secondary two stream instability onset in the post-saturation regime of the classical weibel instability. *Physics of Plasmas*, 18(5):052104.
- Innocenti, M. and Lapenta, G. (2007). Momentum creation by drift instabilities in space and laboratory plasmas. *Plasma Physics and Controlled Fusion*, 49(12B):B521.

Invited presentations at international conferences

- International Conference on Numerical Simulation of Plasmas (ICNSP) 2017, September 18-20, 2017, Leuven, Belgium
M. E. Innocenti, G. Lapenta
The Multi-Level Multi-Domain method for semi-implicit, adaptive, PIC simulations: a review and perspectives
- 14th meeting of the Asia Oceania Geosciences Society (AOGS), August 6-11, 2017, Singapore
M. E. Innocenti, G. Lapenta
Progress towards physics-based space weather forecasting with exascale computing
- 44th European Physical Society (EPS) Conference on Plasma Physics, June 26-30, 2017, Belfast, UK
M. E. Innocenti
Addressing the multiscale nature of the turbulent cascade in the lower-hybrid range
- Astronum 2016, June 6-10, 2016, Monterey, CA, US
M. E. Innocenti, C. Norgren, S. Markidis, G. Lapenta
Study of electric and magnetic field fluctuations from Lower Hybrid Drift Instability (LHDI) waves with the Multi-Level Multi-Domain method
- Astronum 2015, June 8-12, 2015, Avignon, France
M. E. Innocenti, A. Beck, S. Markidis, G. Lapenta

The Multi Level Multi Domain (MLMD) method: a semi-implicit adaptive algorithm for Particle In Cell plasma simulations

- Shock Acceleration from the Solar System to Cosmology, January 5-9, 2015, Leiden, The Netherlands
M. E. Innocenti, G. Lapenta, M. Goldman, D. Newman, S. Markidis
Characterization of the slow shock / rotational discontinuity compound structure in PIC simulations of magnetic reconnection
- European Geosciences Union (EGU) 2014, April 27-May 2, 2014, Vienna, Austria
M. E. Innocenti, A. Beck, T. Ponweiser, S. Markidis, G. Lapenta
Realistic mass ratio magnetic reconnection simulations with the Multi Level Multi Domain method
- 23th International Conference on Numerical Simulation of Plasmas (ICNSP), September 14-16, 2013, Beijing, China
M. E. Innocenti, A. Beck, S. Markidis, G. Lapenta
The Multi Level Multi Domain (MLMD) method: a semi-implicit adaptive method for Particle In Cell plasma simulations

Invited lectures in international schools

- Workshop on Computational Solar and Astrophysical Modeling, September 14-18, 2015, Juelich, Germany
Multi-scale kinetic simulations: the multi-level multi-domain methodology
- 12th International School/Symposium for Space Simulations (ISSS-12), July 3-10, 2015, Prague, Czech Republic
The Implicit Moment Method (IMM) and the Multi Level Multi Domain method (MLMD) for Particle In Cell plasma simulations